A double dissociation between accuracy and time of execution on attentional tasks in Alzheimer’s disease and multi-infarct dementia

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Summary

Two cancellation/attentional tasks: (i) Lines Cancellation (LC) and Multiple Features Targets Cancellation (MFTC) and (ii) a standard battery of neuropsychological tests, the Mental Deterioration Battery (MDB), were administered to 68 patients with dementia of the Alzheimer’s type (DAT) and 40 patients with multi-infarct dementia (MID), who were accurately matched for the overall severity of dementia, and to 40 normal controls. Both accuracy and time of execution were considered in evaluating performance on the two cancellation tasks, which involved visuospatial exploration and psychomotor speed, but were differently demanding in terms of selective attention. On the first cancellation task (LC), requiring a lower attentional load, the two demented patient groups performed at the same level of accuracy. On the second cancellation task (MFTC), which was more demanding in terms of selective and divided attention, DAT patients were significantly less accurate than MID patients, making a higher number of ‘false-alarm’ errors. Conversely, the time employed in the execution of both LC and MFTC took longer for MID than for DAT patients, suggesting a greater impairment of psychomotor speed in MID. In the MDB, DAT patients scored significantly worse than MID patients on several measures of episodic memory (the immediate recall, delayed recall and delayed recognition of Rey’s Auditory Verbal Learning Test) and on a test of visual–spatial memory. These data suggest that, while psychomotor speed and the lower (sensorimotor) level of attention are preferentially impaired in subcortical forms of dementia such as MID, the higher levels of selective and divided attention are more markedly disrupted in the Alzheimer type of dementia.

Keywords: DAT; MID; selective and divided attention; psychomotor speed

Abbreviations:DAT = dementia of the Alzheimer’s type; LC = Lines Cancellation; MANOVA = multivariate analysis of variance; MDB = Mental Deterioration Battery; MFTC = Multiple Features Targets Cancellation; MID = multi-infarct dementia; MMSE = Mini-Mental State Examination; RAVLT = Rey’s Auditory Verbal Learning Test

Introduction

Dementia of the Alzheimer’s type (DAT) and multi-infarct dementia (MID) are usually considered to be the two most frequent forms of dementia (Hebert and Brayne, 1995; Ott et al., 1998), even if recent anatomo-clinical and neuropathological studies (Galasko et al., 1994; Snowden et al., 1997; Nolan et al., 1998) have shown that vascular lesions alone are probably unable to provoke a clear clinical syndrome of dementia. As a consequence of the different locations of neurofibrillary tangles and senile plaques (which represent the elementary pathological lesions of DAT) and of lacunar infarcts (which characterize MID from the neuropathological point of view), DAT and MID patients have different neuropsychological profiles. According to classical neuropathological data (Tomlinson et al., 1970) and to the recent staging system for neurofibrillary tangles proposed by Braak and Braak (1991, 1995), the pathology of DAT first affects the medial temporal–limbic structures (entorhinal cortex and hippocampus) and then spreads to the neocortical association areas, involving the temporoparietal and then the prefrontal cortices. The neuropsychological profile of deficits corresponding to this distribution of neuropathological lesions consists of an initial severe amnesic syndrome (due to the involvement of the hippocampal formations) and successive impairment of other cognitive functions, such as semantic memory, language and visual–spatial functions, which are subserved by neocortical...
association areas. On the other hand, the small lacunar infarcts that characterize the neuropathological picture of MID result in subcortical rather than cortical brain damage as they generally affect the thalamus, the basal ganglia and the periventricular white matter. These subcortical structures are part of the frontosubcortical system (Ishii et al., 1986), which could subserve a variety of basic cognitive and affective functions, such as attention, initiative, the speed of information processing and mood.

Results of neuropsychological studies reported in the literature so far, with the aim of comparing the cognitive abilities of DAT and MID patients (for reviews see Almkvist, 1994; Looi and Sachdev, 1999), are mostly consistent with this general line of thought. Poorer performance is usually found in DAT patients on episodic memory tasks (Hagberg and Gustafson, 1985; Parlati et al., 1988; Gainotti et al., 1989, 1992; Loewenstein et al., 1991; Mendez and Ashla-Mendez, 1991; Barr et al., 1992; Villardita, 1993) and, to a lesser extent, on tasks of language (Loewenstein et al., 1991; Barr et al., 1992; Villardita et al., 1993; Kertesz and Clydesdale, 1994), on tasks of constructional apraxia (Gainotti et al., 1980) and on tasks requiring visual–spatial abilities (Gainotti et al., 1992), whereas inferior performance is observed in MID patients on tasks involving executive functions, attention and psychomotor speed (Mendez and Ashla-Mendez, 1991; Almkvist et al., 1993; Villardita, 1993). It must be acknowledged, however, that some inconsistencies exist in the literature on this issue. In particular, for attentional tasks, whose correct execution is generally considered to depend mainly on the integrity of subcortical structures, no clearcut difference was found between DAT and MID patients with respect either to accuracy or to time of execution on the Continuous Performance (Loring et al., 1986), Digit Symbol (Loring et al., 1986; Mazzucchi et al., 1987), Mesulam’s Figure Cancellation (Mendez and Ashla-Mendez, 1991) and other cancellation tasks (Loring et al., 1986). The discrepancies in results of studies contrasting DAT and MID patients on attentional tasks could be the consequence of either methodological or conceptual problems. The former could derive from the large variability in lesion site, lesion size and lesion number that has been shown by the groups of MID patients enrolled in the various studies and by the fact that in the same studies DAT and MID patients were not always matched in terms of severity of dementia. The latter could stem from the fact that the term ‘attention’ does not denote a single function, but rather a functional system that can be divided into several separate subsystems. This last point has been stressed particularly by Perry and colleagues (Perry and Hodges, 1999; Perry et al., 2000), who recently reviewed neuropsychological data suggesting that some subcomponents of attention (namely, divided attention and some aspects of selective attention subserving response selection) are consistently affected early in the course of Alzheimer’s disease. Following the same line of thought, Rizzo and colleagues reported results of a study showing that deterioration of sustained, divided and selective attention usually occurs in the early stages of DAT (Rizzo et al., 2000).

The present research aimed to clarify this issue by administering two attentional/cancellation tasks that were structurally similar but required different amounts of divided and selective attention to DAT and MID patients with a mild to moderate degree of cognitive impairment, who were carefully matched for the overall severity of dementia. One of these tasks, Lines Cancellation (LC), is based on a simple process of target detection, whereas the second task, Multiple Features Targets Cancellation (MFTC), requires the simultaneous consideration of a few features and the selection of the appropriate targets from an array of distractors. In order to obtain a more detailed picture of the quantitative and qualitative aspects of cognitive impairment in our DAT and MID patients and thus to allow a better comparison between results obtained in the present and in previous studies on attentional tasks, a standard battery of neuropsychological tasks [Mental Deterioration Battery (MDB)] was also administered to DAT and MID patients and to normal subjects. The MDB, described in previous studies (e.g. Gainotti et al., 1980, 1989, 1992, 1998) and validated in normal subjects and demented patients (Caltagirone et al., 1979; Carlesimo et al., 1996), includes tasks of episodic memory [Rey’s Auditory Verbal Learning Test (RAVLT)], language (Word Fluency and Phrase Construction) of immediate visual memory, visual–spatial intelligence (Raven’s Coloured Matrices) and constructional apraxia (Copying Drawings without and with landmarks). All these tasks explore neocortical cognitive abilities that would be expected to be relatively spared in the earliest ‘limbic’ stages of DAT but more impaired in DAT than in MID patients in the advanced stages of disease evolution.

Material and methods

Patients

One hundred and eight patients affected by DAT (n = 68) or MID (n = 40) were selected from a continuous series of patients referred to our Neuropsychology Service because of suspected dementia. These patients were enrolled in our study because they presented a mild to moderate degree of dementia according to the following criteria: (i) meeting the DSM-IV criteria (American Psychiatric Association, 1994) for dementia; (ii) obtaining at least four pathological scores (the cut-off of four or more pathological scores corresponds to the worst result obtained by normal controls in the validation study of the MDB) on the MDB; (iii) being able to complete all the tests of the MDB with at least one score within the normal range. Criteria (ii) and (iii) were used because in previous studies from our group (Gainotti and Marra, 1994; Gainotti et al., 1992, 1998) they enabled us to identify patients with a mild to moderate degree of dementia. The diagnosis of DAT and MID was made by a senior staff neurologist according to the following criteria.
DAT: (i) meeting the NINCDS–ADRDA criteria (McKhann et al., 1984) for probable DAT; (ii) scoring <4 on the Hachinski Ischemia Scale (Hachinski et al., 1975); and (iii) showing mild to moderate cortical atrophy and a more severe hippocampal atrophy at MRI; MID: (i) history of stepwise worsening of focal neurological signs and symptoms attributable to multiple cerebrovascular events and supported by a score on the Hachinski’s Ischemia Scale of ≥7; and (ii) CT or MRI evidence of three or more small infarcts or lacunae involving medium- or small-sized vessels. Patients with large strokes involving the distribution of major vessels were excluded. All patients enrolled had subcortical involvement located in the basal ganglia, and anterior periventricular region, or subfrontal white matter. None had aphasia, hemiparesis, neglect or other visual spatial deficits that would interfere with performance on the neuropsychological test battery.

General exclusion criteria were (i) a history of alcohol or drug abuse or of head trauma; (ii) medical disorders that could affect CNS function (e.g., impaired cardiopulmonary, renal or hepatic function, hypo- or hyperthyroidism, severe anaemia, vitamin B12 and folate deficiency, diabetes mellitus); and (iii) psychiatric disorders (past or present), in particular depressive disorders (major depression or dysthymic disorder, according to DSM-IV criteria), which, in some cases, are associated with ‘depressive pseudodementia’. Clinical evidence of one of these conditions led to exclusion, even if it was not considered to be the relevant cause of cognitive impairment in that particular patient.

Forty normal subjects, carefully matched to the demented groups in terms of age and educational level, formed the control group of the study. All subjects enrolled in the study gave their informed consent and the study was approved by the Ethics Committee of the Medical Faculty of the Catholic University of Rome.

Neuropsychological assessment
All patients were given the Mini-Mental State Examination (MMSE) (Folstein et al., 1975) and the battery of neuropsychological tests described below.

Cancellation/attentional tasks
Lines Cancellation. In this simple task, the patient was requested to cross as quickly as possible 60 lines scattered on a sheet of paper. Accuracy of execution (number of lines correctly crossed) and time of execution were scored separately.

Multiple Features Targets Cancellation. In this task the patient was presented with an array of 80 small squares, each containing two variously oriented lines, and requested to cancel as quickly as possible all the 13 items identical to a model placed immediately above the array (Fig. 1). Again, accuracy and time of execution were assessed separately.

Fig. 1 Multiple Features Targets Cancellation task. The patient is requested to cancel as quickly as possible all the 13 items identical to the model placed above the array.

Accuracy was scored according to the procedure suggested by McNicol (McNicol, 1972) and based on the signal detection theory (Parks, 1966), which takes into account both ‘hits’ (correct identifications) and ‘false alarms’ (false recognitions). The accuracy scores obtained with this procedure ranged from 50 (random performance) to 100 (errorless performance).

Mental Deterioration Battery
The enlarged version of the MDB used in the present study included the following verbal and non-verbal tasks.

Verbal tasks
Phonological Verbal Fluency. The patient was requested to say in 1 min as many words as possible beginning with the letters F, A and S, respectively.

Semantic Verbal Fluency. The patient was requested to say in 2 min as many items as possible belonging to a given semantic category (e.g. flowers, birds).
Rey’s Auditory Verbal Learning Test (Rey, 1958). A list of 15 high-frequency words that were not semantically related was read aloud by the examiner five consecutive times at the rate of one word per second. After each reading the patient had to reproduce as many words as possible in free order. The overall number of words reproduced correctly after the five consecutive administrations of the word list constituted the ‘immediate recall’ score. Fifteen minutes later, without any further reading of the list, the patient was requested to recall as many words as possible. The overall number of correct items reproduced after this interval constituted the ‘delayed recall’ score. Finally, after another 15 min the patient was asked to recognize the target words in a list of 45 items (15 target words plus 30 distractors). The numbers of right and false recognitions obtained during this stage were used to obtain a ‘delayed recognition’ score. This score (which measures recognition accuracy) was computed according to the procedure suggested by McNicol (McNicol, 1972), and was mentioned in the description of the MFTC task.

Digit Span forward and backward (DS-f, DS-b). This is a well-known subtest of the WAIS (Wechsler Adult Intelligence Scale) (Wechsler, 1981).

Non-verbal tasks

Raven’s Coloured Progressive Matrices. This is a visual spatial intelligence test (Raven, 1949), which involves picking from a set of distractors the item that logically completes a given visual spatial pattern.

Immediate Visual Memory. This requires the immediate recognition of 22 abstract visual stimuli within 22 sets of four alternatives.

Copying Drawings. This test requires participants to copy three geometrical figures representing a star, a cube and a house.

Copying Drawings with landmarks. The patient must reproduce the same models of the previous test, but using landmarks already traced on the paper sheet.

Results

General characteristics of DAT, MID and control subjects

Table 1 reports the mean age, educational level and MMSE scores of DAT and MID patients and normal controls. The three groups did not differ in terms of age and years of schooling. The MMSE scores of controls were obviously higher than those of DAT and MID patients, which were not significantly different from each other \( F = 1.74; P < 0.17 \),

<table>
<thead>
<tr>
<th></th>
<th>Alzheimer’s disease (n = 68)</th>
<th>MID (n = 40)</th>
<th>Controls (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>67.8 (6.7)</td>
<td>68.3 (7.6)</td>
<td>69.3 (8.0)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>10.0 (3.0)</td>
<td>9.7 (3.5)</td>
<td>8.4 (4.2)</td>
</tr>
<tr>
<td>MMSE</td>
<td>19.1 (4.2)</td>
<td>20.6 (3.9)</td>
<td>27.7* (2.5)</td>
</tr>
</tbody>
</table>

Data are mean (standard deviation). One-way ANOVA (d.f. 2,145): Post hoc comparison (Duncan test). \*P < 0.01; age, F = 0.40, not significant; years of education, F = 1.74, not significant; MMSE, F = 54.31, P < 0.01.

Table 2 Performance of Alzheimer’s disease patients, MID patients and normal controls on the two cancellation/attentional tasks: Lines Cancellation (LC) and Multiple Features Targets Cancellation (MFTC)

<table>
<thead>
<tr>
<th></th>
<th>Alzheimer’s disease (n = 68)</th>
<th>MID (n = 40)</th>
<th>Controls (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC, accuracy</td>
<td>57.3 (9.2)</td>
<td>56.6 (5.1)</td>
<td>59.8 (0.4)</td>
</tr>
<tr>
<td>LC, time (s)</td>
<td>98.7 (74.6)</td>
<td>&lt; 114.5 (79.6)</td>
<td>&gt; 47.3 (24.5)</td>
</tr>
<tr>
<td>MFTC, hits</td>
<td>7.9 (4.6)</td>
<td>9 (3.4)</td>
<td>&lt; 12.3 (1.2)</td>
</tr>
<tr>
<td>MFTC, false alarms</td>
<td>7.6 (9.6)</td>
<td>&gt; 4 (7.1)</td>
<td>0.4 (0.9)</td>
</tr>
<tr>
<td>MFTC, accuracy</td>
<td>80 (18.4)</td>
<td>&gt; 87.8 (11.6)</td>
<td>&lt; 98.4 (2.7)</td>
</tr>
<tr>
<td>MFTC, time (s)</td>
<td>179.5 (76.2)</td>
<td>&lt; 200.6 (79.7)</td>
<td>&gt; 80.4 (42.3)</td>
</tr>
</tbody>
</table>

Data are mean score (standard deviation). Two-way MANOVA: Rao’s r (d.f. 12, 280), 9.23, P < 0.00001. Post hoc comparisons (Duncan test): \( H_1 \), P < 0.01; \( H_2 \), P < 0.05.

thus confirming that the two demented groups were quite homogeneous for the overall severity of dementia.

Results obtained on the cancellation/attentional tasks by DAT and MID patients

The accuracy and time of execution shown by DAT and MID patients on the LC and MFTC tasks were analysed by two-way multivariate analysis of variance (MANOVA). The distribution of pathological performances on the two cancellation/attentional tasks in the two demented groups was also studied. For this purpose, we first computed the cut-off values for the pathological/normal distinction for each of the attentional measures taken into account, on the basis of the performance of normal controls (i.e. mean score minus two standard deviations); we then calculated the number of Alzheimer’s disease and MID patients who settled below the cut-off values.

Table 2 shows mean scores obtained by the three experimental groups on the various attentional measures described previously. A two-way MANOVA was used. Post hoc comparisons were performed using the Duncan test.

As expected, the two-way MANOVA yielded a significant overall difference between the three groups (Rao’s r = 7.52;
P trend). In fact, the two demented groups scored worse than controls on all the accuracy and time of execution attentional measures taken into account. Post hoc comparisons showed that (i) DAT and MID patients performed at the same pathological level on the accuracy score of the LC task and on the number of hits of the MFTC task; (ii) DAT patients performed worse than MID patients on the accuracy score of the MFTC task (the difference resulting from the higher number of false alarms made by DAT patients); and (iii) MID patients were slower than DAT patients on both the very simple LC task and the more demanding MFTC task.

Table 3 shows the number of pathological performances by DAT and MID patients with respect to the accuracy and time of execution of the two attentional tasks. Analysing the distribution of such performances, no difference emerged between the two demented groups in accuracy levels, whereas there was a significant prevalence of pathological performances in MID patients in comparison with Alzheimer’s disease patients with respect to time employed in the execution of either LC or MFTC.

Results obtained by DAT and MID patients on the Mental Deterioration Battery

Table 4 shows the mean scores obtained by demented patients and control subjects on the various tasks forming the MDB. A two-way MANOVA followed by post hoc comparisons, performed using the Duncan test, was used to test the significance of differences among the three groups.

As expected, the two-way MANOVA yielded a significant overall difference between groups (Rao’s r = 8.78; P < 0.00001), because DAT and MID patients scored significantly worse than normal controls on all the neuropsychological measures of the MDB. When DAT and MID patients were matched directly, a more marked impairment of DAT patients was observed on almost all the recall and recognition subtests of the RAVLT and on the Immediate Visual Memory test. Conversely, the number of recognition hits of the RAVLT and the accuracy score of the MFTC were not significantly different in DAT and MID patients. Similarly, no significant difference between the two demented groups was observed on any other task of the MDB (Digit Span forward and backward, Raven’s Progressive Matrices, Phonological Verbal Fluency, Semantic Verbal Fluency, Copying Drawings without and with landmarks).

Discussion

The main purpose of the present study was to examine two viewpoints about the impairment of attentional functions concerning mild to moderate forms of dementia. According to the first model, which is consistent with the construct of ‘subcortical dementias’ (Cummings, 1990), attentional functions, being subserved by subcortical structures, would be expected to be more impaired in MID than in DAT patients. According to the second model, which derives from the acknowledgement of the multicomponent nature of the attentional system, different facets of attention could be affected differently in different forms of dementia. On this subject, Perry and colleagues (Perry and Hodges, 1999; Perry et al., 2000) recently claimed that tasks based on selective and divided attention may be affected relatively early in the course of Alzheimer’s disease, even before the neurofibrillary tangles spread from the temporolimbic structures to the temporoparietal cortical association areas. Results of the present study show that, in the early stages of dementia, double dissociation can be observed between elementary sensorimotor attentional components, which are disrupted mainly by subcortical lesions typical of MID, and the highest levels of selective and divided attention, which are preferentially disrupted by the pathological changes of DAT. These results are therefore more consistent with the theory of Perry and colleagues (Perry and Hodges, 1999; Perry et al., 2000) than with the construct of subcortical dementias. The hypothesis of a dissociation in MID and DAT between disruption of the most elementary and of the highest components of the attentional system is supported by two main arguments. The first is that, in our MID patients, the selective impairment of the time of execution was independent of the complexity of the cancellation/attentional task, being observed on both the very simple LC and the cognitively more demanding MFTC task. The second argument is that,
in DAT patients, the equally selective impairment of performance accuracy concerned only the ability to distinguish targets from distractors on the MFTC task, as demonstrated by the high number of false alarms made by these patients. This last observation is also consistent with data reported by Rizzo and colleagues (Rizzo et al., 2000) in a recent study, in which DAT patients were described as making frequent false-alarm errors on tasks of sustained attention. These data and the results of the present study seem to confirm the claim of Perry and Hodges that DAT patients are unable to screen out irrelevant stimuli and are prone to the effects of interference from distractors owing to the impairment of ‘inhibitory mechanisms’ (Perry and Hodges, 1999). To support this interpretation, however, it is necessary to exclude the possibility that the pattern of results described above is simply the result of methodological shortcomings. Three main factors could be considered as possible confounders. (i) A non-cognitive variable, namely a depressed mood, may have influenced the performance of DAT and MID patients differently; (ii) specific cognitive disorders rather than proper attentional factors may have affected DAT and MID patients differently; and (iii) the results obtained might be attributable to a difference in the degree of cognitive impairment between the DAT and MID groups.

The first point is suggested by the notion that patients with vascular forms of dementia are often reported as presenting mood disorders (Cummings et al., 1987; Alexopoulos et al., 1997). It could therefore be assumed that the longer time employed by MID patients in the execution of the LC or MFTC task is due to psychomotor retardation produced by depressed mood rather than to impairment of lower-level attentional factors. This hypothesis, though interesting, is contradicted by two main arguments. The first is that psychomotor retardation is usually observed in patients affected by major depression or severe dysthymic disorder (i.e. by the psychiatric conditions that were used as exclusion criteria in the present study). The second point is that a greater incidence of depression in MID than in DAT is generally reported in the advanced stages of the diseases, whereas in the early stages, which were considered specifically in the present study, the presence of depression does not distinguish clearly between MID and DAT patients (Rosen et al., 1980; Cummings et al., 1987).

The second point derives from the evidence that the MFTC task, owing to the relative density of stimuli, involves more stringent visual discriminations than other (visuospatial) tasks of the MDB. Thus, a subtle visual spatial impairment that is not detected by the MDB might have affected the MID and DAT groups differently. If this were the case, i.e. if the different results obtained by MID and DAT patients on the MFTC task were related to visuospatial rather than attentional disorders, then the group of patients more impaired from the visuospatial point of view should have had lower accuracy and a longer time of execution on the MFTC task. The double dissociation between the lower accuracy shown by DAT patients and the longer time of execution exhibited by MID patients suggest, on the contrary, that different subcomponents of the attentional system are affected in the two groups.

Thirdly, the hypothesis that the results obtained in the present study may have been due to a difference in the degree of cognitive impairment presented by MID and DAT patients can be rejected for both theoretical and empirical reasons. The theoretical reason consists in the notion that a double dissociation itself rules out this possibility, pointing to a separate impairment of different components of a functional system (Shallice, 1988). The factual reason lies in the evidence that our two groups of DAT and MID patients were carefully matched for the overall severity of dementia. Results

| Table 4 Mean scores (standard deviation) of Alzheimer’s disease and MID patients and of normal controls on the tasks of the Mental Deterioration Battery |
|-----------------|-----------------|-----------------|
|                 | Alzheimer’s     | MID             | Controls         |
|                 | disease (n = 68)| (n = 40)        | (n = 40)         |
| RAVLT           |                 |                 |                  |
| Immediate recall| 19.4 (8.8)      | 23.4 (9.8)      | 38.2 (9.2)       |
| Delayed recall  | 2.2 (2.1)       | 3.6 (3.1)       | 8.1 (3.2)        |
| Recognition: hits| 9.0 (4.3)     | 9.3 (4.3)       | 13.3 (1.7)       |
| Recognition: false alarms| 9.4 (8.9) | 3.5 (2.7) | 1.7 (2.7) |
| Recognition: accuracy| 73.5 (15.5) | 82.5 (14.1) | 95.0 (4.8)       |
| Immediate Visual Memory| 13.9 (2.8) | 16.2 (3.2) | 19.4 (2.1)       |
| Digit Span forward| 4.9 (1.1)    | 5.1 (1.6)       | 5.6 (0.9)        |
| Digit Span backward| 2.6 (1.7)    | 2.7 (1.4)       | 4.1 (0.8)        |
| Raven’s Coloured Matrices| 17.1 (6.1) | 19.4 (6.2) | 27.0 (4.1)       |
| Phonological Verbal Fluency| 16.7 (9.9) | 20.9 (11.9) | 28.9 (10.1)     |
| Semantic Verbal Fluency| 8.3 (5.0)   | 9.9 (5.2)       | 21.1 (8.2)       |
| Copying Drawings| 6.9 (2.5)       | 7.8 (2.1)       | 10.1 (1.4)       |
| Copying Drawings with landmarks| 48.0 (17.2) | 47.9 (20.0) | 66.9 (4.0)       |

Two-way MANOVA: Rao’s r (d.f. 26, 266): 8.78, P < 0.00001. Post hoc comparisons (Duncan test): <<<|>, P < 0.01; < | > P < 0.05.
obtained on the MMSE and, more convincingly, on the MDB confirm that, with the exception of the expected greater impairment of DAT patients on episodic memory tasks, no significant difference between the two groups of demented patients was observed on tasks of language, visuospatial cognition and constructive abilities that were designed to explore different neocortical cognitive activities.

This last finding is particularly interesting from the viewpoint of the pathophysiological theory proposed by Perry and Hodges (Perry and Hodges, 1999). According to these authors, selective attention and divided attention are the first ‘non-memory’ domains to be affected in DAT, even before neocortical dysfunctions (concerning, for instance, language and visuospatial and constructive activities) become apparent. The fact that, in our series, DAT patients scored significantly worse than MID patients only on tasks of episodic memory and on the accuracy score of MFTC task, and not on tasks of language, visuospatial cognition and constructive abilities, is clearly consistent with this theory. Also consistent with this theory are the results of a study on the predictors of cognitive decline in the early stages of probable DAT that we published recently (Marra et al., 2000). According to these results, the accuracy scores obtained by DAT patients on attentional (MFTC) and episodic (RAVLT) memory tasks seemed to play a pivotal role in discriminating between patients who were eventually classified as ‘fast decliners’ or ‘slow decliners’ after a 10- to 17-month follow-up study.

References


